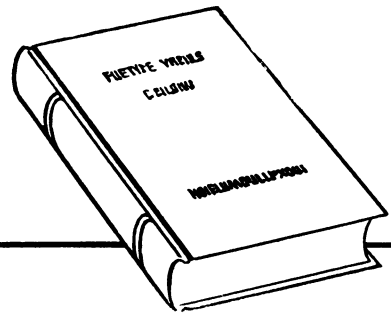

THE PHYSICIAN'S *Bookshelf*

METALS AND ENGINEERING IN BONE AND JOINT SURGERY—Charles Orville Bechtol, M.D., Professor of Orthopedic Surgery and Chairman of Orthopedic Division, University of California, Los Angeles; Chairman of Subcommittee on Testing, Prosthetics Research Board, National Research Council; Albert Barnett Ferguson, Jr., M.D., Silver Professor of Orthopedic Surgery, and Chairman of Orthopedic Department, University of Pittsburgh; Children's and Presbyterian Hospital, Pittsburgh; and Patrick Gowans Laing, M.B., B.S., F.R.C.S., Assistant Professor of Orthopedic Surgery, University of Pittsburgh; Chief of Orthopedic Service, U. S. Veteran's Hospital, Oakland, Pittsburgh. The Williams & Wilkins Company, Baltimore 2, Maryland, 1959. 186 pages, $8.00.

Surgeons have long felt the need for a reliable source of information on metallic implants. Such information has been hard to get, scattered as it is among metallurgical, engineering and other books and journals. Indeed, even when at hand such articles are often difficult to understand because of the engineering and metallurgical terminology—little understood by the average physician. In this book by Bechtol, Ferguson and Laing, this language barrier has been annihilated, the whole subject being simplified and clarified in the language of the practicing surgeon. All phases are illustrated by charts, diagrams and photographs of excellent quality. It contains a wealth of information on the structure of metals, their fabrication into implants, their uses in bone and joint surgery, their care before implantation and what can be expected of them under various environmental and stress conditions after implantation.

With the development of aseptic operating room technique, open reduction of fractures and the use of internal fixation devices became practical and popular. During the early 1900's Lambotte of Brussels plated hundreds of broken bones experimenting with different types of alloys in various shapes and sizes. In his book on this subject are pictured early examples of marrow nailing. The struggle against infection waxed unabated. W. A. Lane (1895) championed a "no touch" technique and so popularized the use of bone plates that to this day many "old timers" automatically say "Lane Plate" whenever the subject is mentioned. The important work of a number of surgeons is succinctly summarized, including a reproduction from the 1913 article of Hey-Groves showing various metallic gadgets, rods, cylinders, and springs inserted in the marrow canals of fragments of experimentally produced fractures. At about the same time Sherman's quest for a "more elastic" plate led to his popularizing the vanadium steel plate which reigned practically unchallenged for some two decades. Early this century it was discovered that Chromium mixed with a Cobalt base produced a new metal with such stellar quantities, that it was called Stellite.

Shortly thereafter surgical implants of this new metal (Vitalium) appeared on the scene. Since Venable and Stuck (1937) published their experimental work on the remarkable corrosion resistance of Vitalium, Cobalt base implants have increased in popularity. During these decades the qualities of stainless steel have also been improved. Today it can be safely said that the throne long occupied by King Vanadium has fallen to a dual occupancy by stainless steel and Vitalium.

Laymen and even some physicians tend to think of bone as an inert, unchanging substance and that a metallic implant is even more static and indestructible. Nothing could be further from the truth. Metals tend to oxidate or corrode, this process being assisted by the acid environment of a fresh fracture, the salinity of tissue juices, or the electro-chemical action of dissimilar metals of an electrolyte process set up between areas. Furthermore, it is now recognized that corrosion may occur between two pieces of similar metal or between different areas of the same plate because of varying degrees of hardness. Against this, metal has a limited capacity to resist corrosion by the spontaneous formation of a thin film of oxide on its surface. Scratching or bending a metallic implant during insertion removes this protective film and hastens the corrosive process. Metals continually shed so that the surrounding soft tissues are slowly saturated with metal which may lead to aseptic inflammation many years after implantation. For this reason metallic implants in young or middle-aged people should always be removed when they have served their purpose.

In addition to these above-described reactions to environment the "internal structure" of metallic implants changes as the result of oft-repeated bend or torsion stresses. Fracture (fatigue) of plates or screws results directly from such repeated stresses rather than age. An implant may break under the repeated occult bending stresses inherent in normal usage of a well-knitted bone. An implant will always fracture in the presence of non-union unless, of course, the screws have so loosened that stresses are no longer transmitted to the plate.

The raw surfaces of such fatigue fractures are characteristic and recognizable. These characteristics are described and there are excellent photographs illustrating them. Methods of measuring hardness of metal, its ability to resist stress and changes produced by bending are described in a way easily understood by those unfamiliar with metallurgy.

The internal structure of metals, how faults and undesirable inclusions may appear in their basic crystalline structure is described and pictured. This is followed by a short discussion of stainless steel, its manufacture, the three main types in common use and finally a description of the type (316) now used by American manufacturers of surgical implants. The essential requirements of metallic corrosion resistance, strength without brittleness, ease of workability, availability and economy are discussed. Vitalium, the popular Cobalt based alloy, is very corrosion resistant but has to be cast and is hence quite expensive. Titanium and Ziriconium are corrosion resistant pure elements which may be more extensively employed in the future.

When a non-corrosion resistant, "soft metal" screw driver is used, tiny metallic fragments are transferred to the screw slot. A "slipping screw driver" will not only damage the oxide surface of the plate but will seed the plate with a

different type of metal. In the same way fragments from hammerheads, punches, etc. seed the ends of prostheses and nails. Thus corrosion currents are established.

The author thus recommends the use of double slotted screws held in a screw-holding screw driver. To further reduce metal transfer and corrosion arising from surface damage he makes many suggestions, a few of which are:

1. Avoid dumping screws and plates together in a box.
2. Keep implants of different composition carefully separated.
3. Avoid seizing screws with a hemostat (unless rubber shod).
4. Never re-use an implant.
5. Never clamp a plate to the bone with a metal clamp.

Dr. Bechtol drilled various sized holes through one cortex of dog femurs and measured the force necessary to fracture them—small holes decreased the breaking strength almost as greatly as larger holes. Conclusion: There is no advantage in making holes smaller than 20 per cent of the outside diameter of the bone. As a result of his extensive experiments, he is able to lay down certain criteria for the manufacture of a more perfect drill for use in bone surgery. These include a chisel point tip whose angle is 90° instead of the customary 56° and dull edges on the spiral flute to prevent reaming out of the hole caused by wobbling. In the application of a bone plate only a limited amount of periosteal stripping is safe—hence bone plates must be small and are necessarily less strong than normal bone. In experiments T or I beam shaped nails are 300 to 400 per cent stronger in resistance to bending force than tri-flanged nails. Parham bands of Vitalium inserted around the mid-femur of dogs, for six weeks caused no grooving from bone absorption under the bands and left the breaking strength unimpaired. He recommends use of the lag screw principle when fixing a spiral fracture, by drilling a slightly larger hole in the proximal cortex. After experimenting with many types of screws he concluded that the size and threads of standard bone screws now in use are quite satisfactory and there is no need for change in design.

DON KING, M.D.

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CLINICAL DERMATOLOGY—For Students and Practitioners—Harry M. Robinson, Jr., B.C., M.D., Professor of Dermatology and Head of the Division of Dermatology, University of Maryland School of Medicine; Chief Dermatologist, University Hospital; and Raymond C. V. Robinson, B.S., M.D., M.Sc. (Med.), Associate Professor of Dermatology, University of Maryland School of Medicine; Assistant Chief of the Dermatology Clinic, University Hospital. The Williams & Wilkins Company, Baltimore 2, Maryland, 1959. 242 pages, $8.50.

This is an attractive two hundred twenty-eight page book. The pages are larger than those of many standard texts, measuring approximately seven and one-half by ten inches. It is printed in double columns on fine paper and in legible type which makes for easy reading.

It appears to be a prime consideration of the authors to present dermatology in a brief and concise manner. The subjects discussed are carefully organized and outlined into major divisions set apart in bold type with subdivisions identified by paragraphing, italics, indentations, outlines and charts. A few drawings and numerous black and white reproductions of photographs are used effectively.

The book is divided into two main sections. The first sixty pages are entitled "General Considerations." The following subjects are presented: (1) Anatomy of the Skin; (2) Physiologic and Chemical Functions of the Skin; (3) Etiology of Dermatoses; (4) Diagnostic Procedures; (5) Dermal Histopathology; (6) Mycology; (7) Allergy; (8) Occupational Dermatoses; (9) Venereal Diseases; (10) Psychosomatic Medicine Applied to Dermatology; (11) Therapy. Considering the scope of the material and the limited space allotted, I believe this part of the book is excellent.

The remainder of the book is headed "Morphologic Dermatology." First come fourteen pages of lists, outlines and charts. In these the common dermatoses are classified as to type of *primary lesion* (macule, papule, vesicle, pustule, et cetera), *configuration* (annular, linear, grouped, et cetera) and other *special features* (excoriations, ulcers, alopecias, et cetera). They are charted as to region or site of predilection, special morphologic features, secondary lesions, subjective symptoms, etiology, diagnostic tests, et cetera.

The remainder and bulk of the book divides the common dermatoses into the following classifications: (1) Macular Eruptions; (2) Papular Eruptions; (3) Vesicular Eruptions; (4) Pustular Eruptions; (5) Eruptions Involving the Scalp and Other Hairy Areas; (6) Lesions Involving the Mucous Membranes; (7) Sweat Gland Lesions; (8) Nail Lesions; (9) Tropical Diseases; (10) Peripheral Vascular Diseases. Each disease in each of these classifications is then outlined under the following sub-headings: (1) Synonym; (2) Sites of Predilection; (3) Objective Symptoms; (4) Subjective Symptoms; (5) Etiology; (6) Histopathology; (7) Diagnostic Aids; (8) Relation to Systemic Disease; (9) Differential Diagnosis; (10) Therapy.

Finally, there is an extensive index.

There are obvious advantages and also some disadvantages to this method of presentation. Among the latter is the fact that the features of many skin diseases are so variable as to defy arbitrary classification in any single morphologic category. This leads to both duplication of material in a few cases and oversimplification in others.

I believe the value of the book is well summarized in the "Foreword" in which it is stated, "The authors, drawing from their vast clinical experience, have prepared a text which is suited ideally as a primer in dermatologic diagnosis for the medical student primarily." It should also serve well as a supplement to lectures in dermatology for student nurses. Finally, it should be helpful for a quick review of dermatology by physicians in general practice or those specializing in other fields than dermatology."

H. V. ALLINGTON, M.D.

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HANDBOOK OF DIET THERAPY—Third Edition—Written and compiled by Dorothea Turner, Department of Medicine, University of Chicago, for the American Dietetic Association. The University of Chicago Press, 5750 Ellis Avenue, Chicago 37, Illinois, 1959. 222 pages, $5.00.

The third edition of the Handbook of Diet Therapy (since 1946) has expanded from 112 to 222 pages. The purpose remains the same: to provide aid in naming, defining and describing therapeutic diets in line with dietetic principles. Definitions of dietetic terminology are included in a 15-page glossary which appears as an appendix. Therapeutic diets are considered as modifications of the normal diet and as such are planned to meet or exceed the dietary requisites of the normal.

In this third edition, basic patterns of diet are outlined in terms of five commonly used food groups. These include the milk group, the vegetable and fruit group, the meat group, the bread-cereal-potato-legume group, and the fats and sweets. Since this fifth group adds little in proteins, minerals and vitamins, it is considered separately from the other four, which contain the essential food elements other than calories.

This handbook is most authoritative in its field. Written primarily for dietitians, it can be extremely valuable to doctors, medical students and others interested in diet therapy.

EDGAR WAYBURN, M.D.